

WEST NILE VIRUS RESPONSE PLAN  
AND  
GUIDANCE DOCUMENT



MACOMB COUNTY HEALTH DEPARTMENT  
2006

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## **EXECUTIVE SUMMARY**

West Nile Virus (WNV) has become endemic in Michigan following the first detection of the virus in the State in 2001. After two years with relatively few human cases, Michigan saw an increase in 2005 with 62 confirmed and probable cases of WNV infection. Four of the cases were reported in Macomb County.

The goal of the Macomb County Health Department West Nile Virus Response Plan and Guidance Documents is to prevent disease caused by mosquitoes through the implementation of a comprehensive education and disease surveillance program and through the promotion of comprehensive mosquito control activities.

### **Public Education and Community Outreach**

The Macomb County Health Department will provide information about WNV, appropriate personal protective measures, and mosquito control activities through media communications, printed materials, presentations to community groups, the Department's website, and a WNV information hotline.

### **Host Surveillance**

Dead birds, especially corvids (crows, ravens, bluejays) continue to be a sensitive indicator of the presence of WNV in an area. The public will be asked to report dead birds to the Macomb County Health Department. The location of all reported birds will be recorded and evaluated to detect possible high infection areas. The Macomb County Health Department will make information about reported dead birds available to municipalities and other agencies conducting mosquito control activities.

### **Human Surveillance and Provider Education**

The Department will continue to provide hospitals and health care providers with criteria for the reporting of cases of WNV infection and guidelines for the collection and submission of laboratory specimens for WNV testing.

### **Mosquito Surveillance**

The Macomb County Health Department will monitor mosquitoes for WNV. Traps will be set at various locations throughout the County to collect adult mosquitoes. Testing for WNV will be performed at the Macomb County Health Department. The location of any WNV-positive mosquito pools will be shared with municipalities and other agencies conducting mosquito control activities allowing for increased public education and mosquito management activities.

## **Mosquito Management**

A timely and appropriate response to mosquito, host, and human surveillance findings is key to preventing an outbreak of WNV infection. The Macomb County Health Department will provide information and direction to local municipalities and other agencies conducting mosquito control activities in assessing and reducing mosquito breeding areas, reducing mosquito habitats, and applying larvicidal agents. If surveillance indicators suggest that the level of WNV activity poses a significant threat to human health, targeted adult mosquito control activities may be recommended.

## **Assessing the Risk of Adverse Health Effects from Pesticide Exposure**

Studies have indicated that the occurrence of adverse health effects is unlikely because of the relatively low levels at which adulticides are applied. However, if the application of adulticides becomes necessary, local municipalities and other agencies conducting mosquito control activities should notify the Macomb County Health Department of planned spraying activities. The Department will contact area hospitals to inform them of planned spraying activities and of the potential adverse health effects from pesticide exposure and will ask hospitals to report any persons presenting with symptoms potentially related to pesticide exposure.

## **PUBLIC EDUCATION AND COMMUNITY OUTREACH**

### **Introduction**

During past years, public education and community outreach activities have highlighted the need for residents to take personal protective measures against mosquito bites and to eliminate mosquito-breeding sites around their homes. The Department provided information through printed materials, its website, and through a West Nile Virus information hotline. Persons that called the hotline had the option of speaking to a staff person during business hours.

### **Objective**

To increase public awareness about West Nile Virus, appropriate personal protective measures, and mosquito control activities.

### **Planned Activities**

The Macomb County Health Department will provide WNV information to the public, especially the elderly (who are more likely to experience severe illness from WNV infection), through written materials, the Department's website ([www.macombcountymi.gov/publichealth/](http://www.macombcountymi.gov/publichealth/)), media communications, group presentations, and a WNV information hotline (**586-469-5473**).

- A. The public will be informed about the Department's preventive strategies and activities to address the threat of WNV and to minimize the necessity of pesticide applications for adult mosquito control.
- B. The public will be asked to help eliminate potential mosquito-breeding sites (tires, buckets, and other water-holding objects) from their property. They will also be urged to change the water in birdbaths once each week, to clean and chlorinate swimming pools (or drain and cover them if not in use), to prevent water from accumulating in pool covers, and to unclog gutters and down spouts.
- C. The public will be informed about the nature of mosquito-borne diseases and the signs and symptoms of WNV infection (headache, high fever, muscle pain, weakness and disorientation).
- D. The public will be informed about personal protective measures that can be taken to avoid mosquito bites such as ensuring that screens fit tightly in doors and windows, wearing protective clothing (long pants, long-sleeved shirts, and socks) and appropriately using insect repellents.
- E. The public will be informed about the importance of reporting dead birds to the Macomb County Health Department for surveillance purposes (**586-469-5236**).

- F. The Department will provide updates to elected officials and community boards as necessary throughout the WNV season.

## **HOST SURVEILLANCE**

### **Introduction**

Many species of birds and other animals can become infected with the West Nile Virus (WNV). However, members of the Corvid family, especially crows, ravens, and blue jays are the most sensitive to the virus and are therefore a good indicator of WNV activity in a particular area. Typically, dead corvids infected with WNV can be found a month or more prior to human transmission.

The Macomb County Health Department began collecting reports of dead birds in 2001 as part of a cooperative project with the Michigan Department of Community Health to detect the presence of WNV in Michigan. The first WNV-positive bird (a crow) was identified in Macomb County in late August 2001. The collection of dead bird reports continued from 2002-2005. Areas of the County with the greatest number of reported dead birds in the 2002 outbreak also had the greatest number of human WNV cases.

### **Objective**

To utilize information about WNV-associated bird mortality as a means of predicting the risk of human WNV infection.

### **Planned Activities**

The Macomb County Health Department will continue to collect reports of dead birds, especially corvids (crows, ravens, bluejays) through the Department's Environmental Health Services Division **(586-469-5236)**. Information about the numbers of dead birds reported and the location of dead birds in the County will be made available to municipalities and other agencies conducting mosquito control activities. This information will be useful in determining the risk of human WNV infection and the need for adult mosquito control activities.

## **HUMAN SURVEILLANCE AND PROVIDER EDUCATION**

### **Introduction**

West Nile Virus (WNV) has become endemic in Michigan since the virus was first detected in the State in 2001. During the past four years the Macomb County Health Department has worked with providers to encourage the immediate reporting of suspected cases of WNV infection and has coordinated the testing of laboratory specimens by the Michigan Department of Community Health.

### **Objective**

To quickly detect human illness due to mosquito-borne diseases, especially WNV.

### **Planned Activities**

- A. The Macomb County Health Department will provide hospitals and health care providers with the criteria for case reporting and guidelines for the submission of laboratory specimens for WNV testing.
- B. The Macomb County Health Department will facilitate the shipment of human specimens (serum, cerebrospinal fluid) to the Michigan Department of Community Health Laboratory for testing.
- C. Information about WNV cases in Macomb County, as well as, mosquito and host surveillance information will be provided to hospitals and health care providers through the Department's website and Communicable Disease Newsletter.



# MOSQUITO SURVEILLANCE

## Introduction

Mosquito surveillance and testing is an essential part of any mosquito-borne disease control program. The risk of mosquito-borne disease depends on both the number of mosquitoes capable of transmitting the disease and the prevalence of the disease-causing virus in the mosquitoes. Surveillance information about adult mosquitoes is important for guiding appropriate prevention and control activities. Adult mosquito surveillance and viral testing provide early predictive information about the potential for human illness.

## Objective

To monitor the distribution and abundance of mosquito populations and to detect the presence of WNV by testing selected mosquito pools for the virus.

## Planned Activities

Mosquito surveillance activities for WNV will be modeled after activities used by the Macomb County Health Department (MCHD) for Eastern Equine Encephalitis (EEE) surveillance. The purpose of mosquito surveillance activities will be to monitor the types and distribution of mosquitoes in the County and to test selected mosquitoes for the presence of WNV. All mosquito testing for WNV will be conducted at the MCHD using the VecTest WNV antigen assay. Test results will be forwarded to the Michigan Department of Agriculture (MDA).

### A. Adult Mosquito Surveillance

1. Once per week, from June through September, the MCHD will trap adult mosquitoes at selected sites throughout the County.
2. Traps will be located in potential mosquito breeding areas and areas where dead crows or cases of human WNV infection have been reported.
3. Light traps and gravid traps will be utilized. Light traps will be hung as high off the ground as possible. Gravid traps will be utilized during the early and mid summer months only since female mosquitoes stop laying eggs during late summer in preparation to over-winter.
4. Traps will be set out in the afternoon and collected the following morning.

### B. Laboratory Testing of Mosquito Specimens

Not all mosquito species are appropriate for arbovirus testing. Therefore, only certain species will be submitted for testing. Target species for laboratory submission vary by the disease pathogen of concern. *Culiseta melanura* is the primary vector species for EEE.

For WNV, members of the genus *Culex* will be given priority for testing, in particular *Cx. pipiens*, *Cx. restuans*, and *Cx. salinarius*, and species associated with *Culex pipiens* (*Ochlerotatus japonicus*, *Oc. triseriatus*, *Oc. cantator*, and *Aedes vexans*).

1. Each week during the collection season the contents of collected traps will be sorted. Non-mosquito species and male mosquitoes will be discarded. The location, date, trap type, and number of female mosquitoes collected will be recorded.
2. For each collection site, female *Culex* mosquitoes will be pooled and tested for WNV by the MCHD using the VecTest WNV antigen assay.

## **MOSQUITO MANAGEMENT**

### **Introduction**

Although mosquitoes are most active in Michigan from June through October, a strong mosquito management program is a comprehensive year-round activity. Information provided in this section is intended to provide guidance to agencies that are considering implementing a mosquito control program and to emphasize that control measures are unlikely to eradicate mosquitoes or West Nile Virus (WNV). Therefore, the goal is to prevent amplification of the virus to the extent that it places humans and animals at risk of illness.

The basis of any mosquito management program should be sound biological information. Before any control measures are undertaken, it is necessary that a comprehensive survey be conducted to determine potential breeding areas, potential over-wintering areas and the mosquito species in the area. *Culex* mosquitoes are believed to be the primary vector in the transmission of WNV to humans, horses and other animals.

Municipalities and other agencies that implement mosquito control activities should give the highest priority to the elimination of mosquito breeding areas and larviciding. The targeted application of adulticides should be a supplement to these activities and should be considered when surveillance information indicates that WNV activity poses a significant risk for human illness.

### **Objective**

To reduce the abundance of adult mosquitoes through the use of integrated mosquito management practices.

### **Planned Activities**

The Macomb County Health Department will provide information and consultation to municipalities and other agencies implementing mosquito control activities.

### **Recommended Mosquito Control Activities**

#### **A. Elimination of Breeding Areas**

All mosquitoes begin their life in water. Eliminating breeding sites is the simplest and most effective way to reduce the number of mosquitoes. Residential, commercial, and public property owners should be encouraged to inspect their properties and eliminate conditions that are favorable for mosquito breeding. Municipalities should also strictly enforce nuisance or other ordinances related to standing water. If the elimination of standing water is not possible, the water can be treated with a larvicide to prevent mosquitoes from developing. Prime mosquito breeding sites include:

- Discarded tires
- Poorly maintained bird baths or swimming pools
- Clogged rain gutters
- Outside containers (e.g., tin cans, buckets, drums, or bottles)
- Low areas or depressions where water remains for a week or more
- Sites where water can not be eliminated such as catch basins, drains, and ditches (these are common breeding sites for *Culex* mosquitoes in urban areas)

## B. Larval Mosquito Control

During the larval stage mosquitoes are confined to water and are generally more susceptible to control measures than they are during the adult stage. **Larvicides must be registered (licensed) with the United States Environmental Protection Agency (EPA) and the Michigan Department of Agriculture (MDA), used according to label directions, and applied by a licensed pesticide applicator (unless applied to private land by the property owner).** Different formulations allow for the selection of a product to meet varying conditions and needs.

The degree of success in larval control is dependent upon a variety of conditions. These conditions include the following:

- Whether or not larvae are actually present in the water to be treated
- The target mosquito species involved
- The type of habitat to be treated (permanent or temporary pool or pond, flood water, artificial container, polluted or clean water, etc.)
- The size of the area to be treated
- The depth and movement of the water to be treated
- The amount of domestic water use

### 1. Biological Management

There are many bacterial, fungal, and viral pathogens which attack or kill mosquito larvae. Products that contain these pathogens are considered ideal for mosquito management because of their specificity to mosquito larvae and their lack of toxicity to humans. When eaten by mosquito larvae, they dissolve and paralyze the cells in the gut, interfering with normal digestion and trigger the larvae to stop feeding.

Death typically occurs within a few hours of ingestion. The most common biological agents are:

- *Bacillus thuringiensis israelensis* (Bti) sold under the trade name “VectoBac”, “Aquabac”, “Teknar” and others
- *Bacillus sphaericus* sold under the trade name “Vectolex”

## 2. Chemical Management

Chemical larvicides can be used to control mosquitoes in the aquatic stage before they become biting adults. This type of control measure generally has little effect on the environment and non-target species of insects and animals. The most common chemical larvicides used include:

- Temephos sold under the trade name “Abate”
- Methoprene sold under the trade name “Altosid”
- Oils sold under the name “Golden Bear-111”, “Bonide”, or “BVA2”
- Monomolecular surface film sold under the name “Arosurf MSF” or “Agnique MMF”

## C. Adult Mosquito Control

The purpose of adult mosquito control is to reduce the number of biting female mosquitoes to a level where they pose a minimal disease threat to humans and other animals. Adult mosquito control can be accomplished through the targeted application of registered aerosol insecticides and should be considered only when mosquito surveys and disease surveillance information indicate the need.

In order to kill the adult mosquito the aerosol must be applied so that it contacts the mosquito. The degree of success is dependent upon a variety of conditions. These conditions include the following:

- The timing of application
- The wind speed and direction
- The temperature
- The size of the treatment area and its location
- The weather conditions (current and forecasted)

- The insecticide used and the application method
- The frequency of treatment
- Applicable laws and regulations
- The resources available (equipment, personnel, funds)

**Adulticides must be registered with the United States Environmental Protection Agency (EPA) and the Michigan Department of Agriculture (MDA), used in accordance with label directions, and applied by a licensed pesticide applicator.** In addition, municipalities and other agencies conducting mosquito control activities may be required to meet specific use, application and public notification requirements detailed in Michigan Act 451 of 1994, Part 83; Regulation 636; and Regulation 637.

The two most common methods for adulticide application are ultra-low volume (ULV) misting and barrier spraying.

#### 1. Ultra-Low Volume (ULV) Misting

ULV misting applications use spray equipment that is hand-held, vehicle mounted, or fixed to an aircraft and allow for the use of a small amount of material (generally about 1-5 fluid ounces per acre) distributed in the form of tiny droplets in a narrow band of time and space. ULV misting applications are most effective when mosquitoes are flying. Therefore, application should take place during normal flying times (dusk and dawn). Although some species are active throughout the night, most mosquito species become less active one to three hours after sunset.

With ground equipment, the direction of movement of the small droplets is dependent on the existing wind direction. The material must be released upwind from the area to be treated which may present a problem for vehicle mounted equipment when road or street networks are limited. Strong winds (above 8-12 mph) may also dissipate the pesticide droplets too rapidly and thermal currents may lift the material above the target area.

Insecticides most commonly used in ULV misting applications are Resmethrin, Sumithrin (which are synthetic pyrethroids), and Malathion (an organophosphate). These insecticides provide rapid knockdown of adult mosquitoes and present minimal risk to mammals when used at the appropriate dosages.

#### 2. Barrier Spraying

This application method involves spraying insecticide onto vegetation surrounding the area to be protected such as backyards, cemeteries, parks, golf courses, etc. The insecticide provides a residual of active ingredient on plant leaf

surfaces, and when mosquitoes try to move from the harborage area through this zone into the open to bite, they are repelled or killed. Equipment for barrier-spraying varies with the size of the area to be protected, but can range from a small hand pump sprayer to a motorized backpack sprayer or a large turbine rig.

## **ASSESSING THE RISK OF ADVERSE HEALTH EFFECTS FROM PESTICIDE EXPOSURE**

### **Introduction**

Because adulticides are normally applied in small amounts, adverse health effects are not likely to occur. However, because exposure to any pesticide has the potential to cause adverse health effects, particularly among those with pesticide sensitivity or respiratory conditions, each community or agency conducting adult mosquito control activities should notify the public before adulticide applications occur.

### **Objective**

To determine if people exposed to pesticides used for adult mosquito control experience adverse health effects.

### **Planned Activities**

- A. Municipalities and other agencies planning adulticide applications should notify the Macomb County Health Department by telephone **(586-469-5236)** at least two working days prior to application. The Department will contact area hospitals to inform them of planned spraying activities and to ask them to report persons that may have experienced adverse health effects related to adulticide exposure. Hospitals will also be given information about the possible adverse health effects associated with those pesticides that will be used.
- B. The Macomb County Health Department will provide consultation to municipalities and other agencies planning adulticide applications to help limit the chances of adverse health effects.



## **REFERENCES**

Comprehensive Mosquito Surveillance and Control Plan 2002, The City of New York Department of Health, 2002.

Michigan Mosquito Manual, Michigan Department of Agriculture and Michigan Mosquito Control Association, September 2002

Epidemic/Epizootic West Nile Virus in the United States: Revised Guidelines for Surveillance, Prevention, and Control, Centers for Disease Control and Prevention, April 2001.

## **APPENDIX A**

### **QUESTIONS AND ANSWERS ABOUT WEST NILE VIRUS**

**Q: What is West Nile Virus (WNV)?**

A: WNV is a mosquito-borne virus that can cause encephalitis (inflammation of the brain) or meningitis (inflammation of the lining of the brain and spinal cord). It also can cause a milder form of illness known as West Nile fever.

**Q: How is West Nile Virus (WNV) spread?**

A: WNV is spread to humans by the bite of an infected mosquito. A mosquito becomes infected after biting a bird that carries the virus. The virus can also be spread through blood transfusion, organ transplantation, breastfeeding, and during pregnancy from mother to baby. WNV is not spread by person-to-person contact such as touching, kissing or caring for someone who is infected.

**Q: Who is most at risk for getting encephalitis after being bitten by a West Nile Virus-infected mosquito?**

A: Persons older than 50 years of age have the highest risk of severe disease, such as encephalitis.

**Q: Where did the West Nile Virus (WNV) come from?**

A: WNV was first identified in Uganda in 1937. The virus is commonly found in Africa, Egypt, Israel, Asia, Romania, Russia and France. Before 1999, the WNV had never before been found in the Americas. The virus was most likely introduced by an infected bird or mosquito that was imported from a country where the virus is common.

**Q: Can you get West Nile Virus (WNV) directly from birds?**

A: No. There is no evidence that WNV can be spread from birds to people. However, dead birds can carry a variety of other diseases and should never be handled with bare hands. Use gloves to carefully place dead birds in double-plastic bags and then place dead birds in the outdoor trash.

**Q: Besides mosquitoes, can you get West Nile Virus (WNV) directly from other insects or ticks?**

A: Infected mosquitoes are the primary source of WNV. Although several types of ticks in Africa and Europe have been found infected with WNV, there is no information to suggest that ticks or other insects in this country are able to transmit WNV.

**Q: What are the symptoms of West Nile Virus?**

A: Most people who are infected with WNV either have no symptoms or experience a very mild illness such as a fever, headache and body aches before fully recovering. Some persons also develop a mild rash or swollen lymph glands. In a very small number of individuals, particularly the elderly, WNV can cause encephalitis. Symptoms of encephalitis include the rapid onset of severe headache, high fever, stiff neck, confusion, loss of consciousness (coma), muscle weakness, numbness, or paralysis. These symptoms may last several weeks and neurologic effects may be permanent.

**Q: How is encephalitis caused by West Nile Virus (WNV) treated?**

A: There is no specific therapy. In more severe cases, intensive supportive therapy is indicated, i.e., hospitalization, intravenous (IV) fluids and nutrition, airway management, ventilatory support (ventilator) if needed, prevention of secondary infections (pneumonia, urinary tract, etc.) and good nursing care.

**Q: Is there a vaccine against West Nile Virus (WNV)?**

A: No. A human vaccine for WNV does not exist.

**Q: How long does it take to get sick if bitten by an infected mosquito?**

A: Most people who are infected with West Nile Virus have no symptoms or experience only mild illness. If illness does occur, symptoms appear within 3 to 15 days of being bitten by an infected mosquito.

**Q: What should I do if I think I have West Nile Virus encephalitis?**

A: You should seek medical care as soon as possible if you develop signs of encephalitis, such as fever, muscle weakness, and confusion,

**Q: What can I do to reduce my risk of becoming infected with West Nile Virus (WNV)?**

A: From June through October, when mosquitoes are most active, take the following precautions:

- Wear protective clothing such as long pants and long-sleeved shirts.
- Avoid shaded, bushy areas where mosquitoes like to rest.
- Limit outdoor activity, especially at dusk and dawn when mosquitoes are most active.
- Use insect repellent containing between 13-25% DEET to minimize the risk of being bitten by a mosquito. Formulations containing more than 25% DEET are unnecessary and may increase the chance of skin reactions. Extra precaution should be used when applying

repellents to children and infants. As with all products, the user should follow the manufacturer's usage recommendations.

**Q: What can I do around my home to help reduce exposure to mosquitoes?**

A: Mosquitoes lay their eggs in standing or slow moving water. Also weeds, tall grass, and bushes provide an outdoor resting place for mosquitoes. Mosquitoes breeding or resting on your property can then enter your home through unscreened windows or doors, or broken screens.

- Repair or replace all screens in your home that have tears or holes.
- Eliminate any standing water that collects on your property.
- Remove all discarded tires from your property.
- Dispose of tin cans, plastic containers, ceramic pots, or similar water-holding containers.
- Make sure roof gutters drain properly. Clean clogged gutters in the spring and fall.
- Clean and chlorinate swimming pools, outdoor saunas and hot tubs. If not in use, keep them empty and covered.
- Drain water from pool covers.
- Change the water in bird baths once each week.
- Turn over plastic wading pools and wheelbarrows when not in use.
- Remind or help neighbors to eliminate breeding sites on their properties.

**Q: What health risks are posed to people and pets from pesticides used to kill adult mosquitoes?**

A: In the amounts used, risks to people and pets are relatively low. However, some people may be more sensitive to such pesticides and may want to reduce their chance of exposure by staying indoors during spraying activities. Anyone experiencing persistent or significant adverse reactions to pesticides should seek medical care or call the Poison Control Center at **1-800-222-1222**.

**Q: Will the public be notified in advance about spraying activities?**

A: Residents can learn about adulticiding schedules in advance through public service announcements and the media or by contacting the appropriate municipality.

**Q: If my community sprays pesticides for adult mosquitoes, what should I do during the spraying?**

A: The EPA does not require relocating or taking special precautions during mosquito control spraying. However, some people may prefer to avoid or to minimize exposure by staying indoors, keeping their windows closed, keeping their air conditioners and window fans off, keeping their children's toys indoors and keeping their pets indoors. Since the effects of ground and aerial spraying dissipate in a few hours, it is not necessary to wash off outdoor furniture or playground equipment before use, although doing so will not diminish the effectiveness of the pesticide application. Anyone experiencing adverse reactions to pesticides should seek medical care or call the Poison Control Center at **1-800-222-1222**.

**Q: If I live in an area where birds or mosquitoes with West Nile Virus (WNV) have been reported, and a mosquito bites me, am I likely to get sick?**

A: No. Evidence indicates that the chance of human infection and illness resulting from WNV is quite low. In addition, the greatest risk is to those over age 50, particularly the elderly. These members of the population should take the greatest care to prevent exposure to mosquito bites.

**Q: I've gotten a mosquito bite. Should I be tested for West Nile Virus (WNV)?**

A: No. Illnesses related to mosquito bites are still uncommon. However, you should see a doctor immediately if you develop symptoms such as high fever, confusion, muscle weakness, severe headaches, and stiff neck or if your eyes become sensitive to light. Patients with mild symptoms should recover completely and do not require any specific medication or laboratory testing.

**Q: Should I report dead birds to the Health Department?**

A: Yes. The Macomb County Health Department encourages Macomb County residents to report all dead bird sightings within the county, especially corvids (crows, ravens, bluejays) to the Environmental Health Services Division at **(586-469-5236)**. This will help the Department to monitor possible West Nile Virus activity.

## **APPENDIX B**

### **CONSIDERATIONS FOR ADULT MOSQUITO MANAGEMENT FOR LOCAL MUNICIPALITIES AND OTHER AGENCIES**

The main objective of mosquito management is to decrease the risk of human West Nile Virus (WNV) infections. This should be primarily accomplished by:

- The reduction of mosquito habitats and breeding sites;
- Larviciding where feasible and practical;
- The use of personal mosquito protection measures, especially for the elderly and immunocompromised.

Adulticiding is a *supplementary* measure and is a local decision that should be based on the considerations listed below.

#### **When to Spray**

There are no specific criteria to help determine when adulticiding should be done. The Macomb County Health Department will provide information and consultation to municipalities and other agencies considering adulticiding activities. Recommendations will be based on current mosquito, host, and human surveillance information.

The goal of spraying is to reduce the risk of human disease by decreasing the number of adult mosquitoes as much as possible. The pesticide is effective only when it makes contact with a mosquito. This is most likely to happen when mosquitoes are actively flying. Therefore, it is imperative that spraying take place between dusk and dawn when *Culex* mosquitoes (the primary target mosquitoes) are most active.

It is also important to note that spraying is less effective during inclement weather. Rain, fog, or high winds will simply knock the pesticide mist to the ground, rendering it inactive. In addition, spraying at temperatures below 55-60 degrees is less effective. At these temperatures, mosquitoes are slower and are usually resting on the ground in the shrubbery and leaf litter where the pesticide mist is unlikely to reach them.

#### **Where to Spray**

Another consideration is the terrain in the proposed spraying area. Dense vegetation can interfere with truck mounted insecticide applications. In situations such as these, municipalities and other agencies that choose to spray may wish to consider backpack sprayers, or altering their route so that trucks can more efficiently apply the spray. Aerial application may be considered when all other methods of application are inadequate and/or ineffective.

The Michigan Department of Agriculture (MDA) should be contacted for guidance in situations that involve spraying near water or in areas that might be hindered by vegetation.

### **Mosquito Population**

Mosquito surveillance information can be helpful in determining when to conduct mosquito control activities and in monitoring the effectiveness of these activities. While all mosquitoes do not need to be tested specifically for the presence of WNV, those that are tested can provide valuable information regarding spraying decisions. It is important to note that surveillance efforts to detect the virus in birds are much easier to conduct than similar efforts to detect the virus in mosquitoes.

What may be more important than actually testing mosquitoes for WNV, is knowing the NUMBERS and SPECIES of the mosquito population in a particular area. The best way to do this is by mosquito trapping. Systematic mosquito trapping, however, requires specially trained staff and is time intensive. For municipalities and other agencies without this capacity, there are other ways to obtain information about mosquito activity. Staff can visually inspect the area where dead birds have been found, or around human population centers for habitats likely conducive to mosquito breeding. Staff can also personally observe mosquito activity.

### **Local Perspectives on Spraying**

Different communities have varying perspectives on the benefits of mosquito control. These should be taken into account in the decision whether or not to spray. This can be difficult, as many people have strong opinions on both sides of the issue. The United States Environmental Protection Agency (EPA) has approved these chemicals for use and they must go through rigorous testing in order to get that approval.

Whether or not a community or agency chooses to spray, it is recommended that the MDA be contacted to obtain information about licensing requirements, application methods, notification requirements and potential adverse health effects of the commonly used pesticides. Colleagues in other cities and agencies may also be a good source of information. The decision regarding spraying is basically a risk assessment: whether or not the risk of contracting WNV is greater than the risk from applying pesticides for mosquito control.

## APPENDIX C

### SELECTED PESTICIDES FOR MOSQUITO CONTROL

***Bacillus thuringiensis israelensis (Bti)*** is a biological larvicide used for mosquito control and may be registered under various trade names such as Vectobac. Bti is usually classified as slightly toxic to practically nontoxic depending on the formulation. Bti forms a protein that binds to receptors in the gut of the mosquito larvae. This damages the lining of the intestine and paralyzes the gut killing the insect. The intestinal receptors where the protein binds are specific to insects and not found in mammals.

***Bacillus sphaericus (Bs)*** is a biological larvicide used for mosquito control and may be registered under various trade names such as Vectolex. Bs produces a protein that acts in a similar manner as Bti. Bs is classified as practically nontoxic. The advantage of Bs over Bti is a longer period of larvicidal activity.

**Methoprene** is a growth inhibitor used for mosquito control and may be registered under various trade names such as Altosid. Methoprene disrupts the development of the pupa into an adult. Methoprene has less specificity to other freshwater invertebrates and is classified as practically nontoxic to humans and other mammals. Methoprene degrades rapidly in water.

**Temephos** is an organophosphate insecticide and may be registered under various trade names such as Abate. Temephos interrupts the function of the nervous system by interfering with key enzymes controlling the transmission of nerve impulses. Temephos is slightly toxic to humans and other mammals. It is a broad-spectrum insecticide and as such can be highly toxic to other invertebrates, some birds, and fish if misused.

**Mineral oil and monomolecular films** can be used as a larvicide and are practically nontoxic. Mineral oil (with an added surfactant) may be registered under various trade names such as Bonide and Golden Bear. These compounds block the breathing tubes of the larvae and pupa. Monomolecular films may be registered under various trade names such as Agnique. Monomolecular films spread across the water decreasing its surface tension preventing larvae, pupae, and adult mosquitoes from staying afloat.

**Pyrethrins** are insecticides derived from substances isolated from the flowers of the chrysanthemum and may be registered under various trade names such as Pyrocyde. Pyrethrins interrupt the function of the nervous system by interfering with the conduction of nerve impulses. Pyrethrins are slightly toxic to humans and practically nontoxic to birds. It is a nonspecific insecticide and therefore can be toxic to other insects and fish.

**Resmethrin** is a pyrethroid insecticide and may be registered under various trade names such as Scourge. Pyrethroids are manmade chemicals similar to pyrethrins but have increased chemical stability and effectiveness. Resmethrin interrupts the function of the nervous system by interfering with the conduction of nerve impulses. Resmethrin is slightly toxic to humans and



other mammals and practically nontoxic to birds. It is a nonspecific insecticide and therefore can be toxic to other insects and fish.

**Permethrin** is a pyrethroid insecticide and may be registered under various trade names such as Biomist and Permanone. Permethrin acts in the same manner as Resmethrin and is slightly toxic to humans and practically nontoxic to birds. It is a nonspecific insecticide and therefore can be toxic to other insects and fish.

**Sumithrin (d-phenothrin)** is a pyrethroid insecticide and may be registered under various trade names such as Anvil. Sumithrin acts in the same manner as Resmethrin. Sumithrin is practically nontoxic to humans and other mammals. It is a nonspecific insecticide and therefore can be toxic to other insects and fish.

**Malathion** is an organophosphate insecticide and may be registered under various trade names such as Fyfanon. Organophosphates act on the nervous tissue to prevent nerve conduction. Malathion is toxic to other insects and fish, but is slightly toxic to humans and other mammals.

**Chlorpyrifos** is an organophosphate insecticide and may be registered under various trade names such as MosquitoMist. Chlorpyrifos is highly toxic to other nontarget insects and fish, but is slightly toxic to humans and other mammals.

**Naled** is an organophosphate insecticide and may be registered under various trade names such as Trumpet. Naled is toxic to other nontarget insects, humans, animals and fish.

The use of proprietary or trade names mentioned above does not constitute an endorsement of the product.

## APPENDIX D

### SELECTED MOSQUITO CONTROL REFERENCES

Agency	Title	Website Address
MDA	West Nile Virus Web Site	<a href="http://www.michigan.gov/emergingdiseases">http://www.michigan.gov/emergingdiseases</a>
	West Nile Virus in Horses	<a href="http://www.michigan.gov/emergingdiseases">http://www.michigan.gov/emergingdiseases</a>
	Community Spray Program Pamphlet	<a href="http://www.michigan.gov/emergingdiseases">http://www.michigan.gov/emergingdiseases</a>
	Information on Mosquito Repellents	<a href="http://www.michigan.gov/emergingdiseases">http://www.michigan.gov/emergingdiseases</a>
	Questions and Answers About West Nile Virus	<a href="http://www.michigan.gov/emergingdiseases">http://www.michigan.gov/emergingdiseases</a>
MMCA	Michigan Mosquito Manual	<a href="http://www.mimosq.org">http://www.mimosq.org</a>
USEPA	Joint Statement on Mosquito Control	<a href="http://www.epa.gov/pesticides/factsheets/mosquitojoint.htm">http://www.epa.gov/pesticides/factsheets/mosquitojoint.htm</a>
	Mosquito Control	<a href="http://www.epa.gov/pesticides/health/mosquitoes.htm">http://www.epa.gov/pesticides/health/mosquitoes.htm</a>
	Pesticides for Mosquito Control	<a href="http://www.epa.gov/pesticides/health/mosquitoes/control.htm">http://www.epa.gov/pesticides/health/mosquitoes/control.htm</a>
	Larvicides for Mosquito Control	<a href="http://www.epa.gov/pesticides/health/mosquitoes/larvicides4mosquitos.htm">http://www.epa.gov/pesticides/health/mosquitoes/larvicides4mosquitos.htm</a>
	Synthetic Pyrethroids for Mosquito Control	<a href="http://www.epa.gov/pesticides/health/mosquitoes/pyrethroids4mosquitos.htm">http://www.epa.gov/pesticides/health/mosquitoes/pyrethroids4mosquitos.htm</a>
	Using Insect Repellents Safely	<a href="http://www.epa.gov/pesticideshealth/mosquitoes/insectrp.htm">http://www.epa.gov/pesticideshealth/mosquitoes/insectrp.htm</a>
CDC	Insect Repellent DEET	<a href="http://www.epa.gov/pesticides/factsheets/chemicals/deet.htm">http://www.epa.gov/pesticides/factsheets/chemicals/deet.htm</a>
	DEET	<a href="http://www.cdc.gov/ncidod/dvbid/westnile/qa/insect_repellent.htm">http://www.cdc.gov/ncidod/dvbid/westnile/qa/insect_repellent.htm</a>
Rutgers University, NJ	Products and Promotions that have Limited Value for Mosquito Control	<a href="http://www-rci.rutgers.edu/~insects/proprom.htm">http://www-rci.rutgers.edu/~insects/proprom.htm</a>

MDA - Michigan Department of Agriculture  
MMCA - Michigan Mosquito Control Association  
USEPA - United States Environmental Protection Agency  
CDC - Centers for Disease Control and Prevention

## **APPENDIX E**

### **MACOMB COUNTY HEALTH DEPARTMENT CONTACT TELEPHONE NUMBERS**

**To report dead birds or planned application of adulticides:**

**Macomb County Health Department  
Environmental Health Services Division**

**(586) 469-5236**

**For general West Nile Virus (WNV) information:**

**Macomb County Health Department Website**

**[www.macombcountymi.gov/publichealth](http://www.macombcountymi.gov/publichealth)**

**West Nile Virus Information Hotline**

**(586) 469-5473**

**To report human cases of West Nile Virus:**

**Macomb County Health Department  
Communicable Disease Program**

**(586) 783-8190**